2014

WATER QUALITY MONITORING PLAN

WOOD DISCOVERY FARM

SITES CVC3 AND CVC4

Water Quality Monitoring Plan

For

MIKE DANIELS
DIVISION OF AGRICULTURE – UNIVERSITY OF ARKANSAS SYSTEM

Monitoring Station CVW3: Mike Wood Farm, 225 Highway 1B, Cherry Valley AR, 72324

CVW3 = NRCS Site AR0371403

Monitoring Station CVW3: Mike Wood Farm, 225 Highway 1B, Cherry Valley AR, 72324

CVW4 = NRCS Site AR0371403

February 17, 2014

Mike Daniels
University of Arkansas
Division of Agriculture
Cooperative Extension Service
Little Rock, AR 72204

Roles and Responsibilities

The following people have been involved in the development of this water quality monitoring plan:

Participant:	Mike Wood
Data Collector:	Mike Daniels University of Arkansas Division of Agriculture Cooperative Extension Service Little Rock, AR 72204
Certified Planner:	Alice Weeks Water Quality Engineer USDA-NRCS Fort Smith, AR
District Conservationist:	Kieth Scoggins District Conservationist, Cross County P.O. Box 247 Wynne, AR, 72396-0247

Participant – will follow this plan and ensure the monitoring activity is carried out on the identified field(s). The participant is also responsible for meeting any reporting deadlines and will work closely with the data collector in completing operational forms that outline all management practices completed on the monitored field(s).

Data Collector – is responsible for installing and maintaining monitoring system. In addition, they ensure quality data are obtained by following all aspects of the Quality Assurance Project Plan (QAPP). As outlined in the QAPP, data collection, analysis, storage and reporting are performed by the data collector on behalf of the participant. Another key role of the data collector is to hold a yearly meeting with the participant to review what was learned about constituent loads during the year.

Certified Planner – is responsible for reviewing the Monitoring Plan developed by the data collector to ensure all required elements are present. They are also responsible for ensuring the participant understands all aspects of the monitoring activity including site accessibility and duration of monitoring.

District Conservationist – is responsible for maintaining an awareness of what is taking place on the site to ensure monitoring is moving forward in an acceptable manner. They are also responsible for obtaining all reported information from the participant and forwarding this information to the state monitoring specialist for storage, review and certification

PURPOSE

This monitoring plan identifies the monitoring activities that will be performed on private land controlled by Mike Woods Farm within the Cross County Conservation District under the Mississippi River Basin Healthy Watershed Initiative for L'Anguille River watershed. Monitoring is being performed to determine the benefits of irrigation water management to reduce nutrient and sediment in runoff in rice and soybean production.

Site Description

Station Identification and Location Map

The Mike Woods farm is a 2700 acre row crop farm (Photo 1) that produces rice and soybeans and is located in the L'Anguille River Watershed, an approved MRBI project area in Cross County in Northeastern Arkansas sponsored by the L'Anguille River Watershed Coalition: (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/ar/programs/landscape/?cid=nrcs142p2_034806)

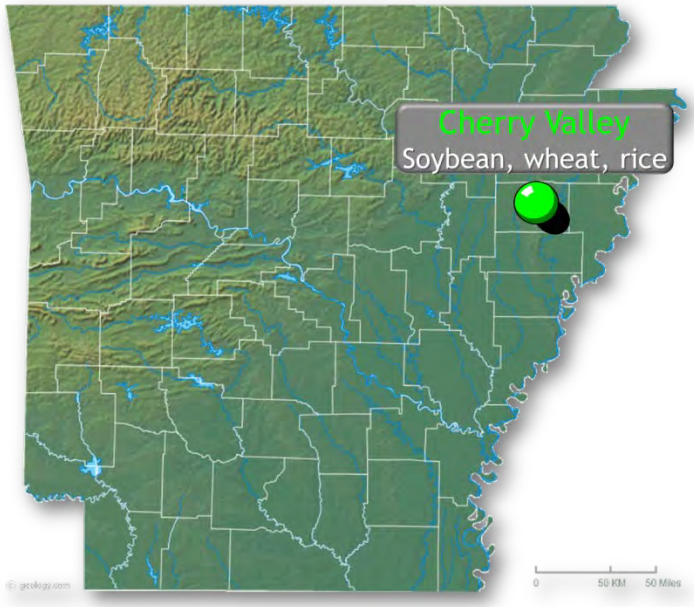

Photo 1: Location of the Mike Wood farm near Cherry Valley, Arkansas

In 2014, we will establish two new monitoring sites on the Mike Wood farm in the L'Anguille River Watershed, an approved MRBI project area in Cross County in Northeastern Arkansas sponsored by the L'Anguille River Watershed Coalition. The two sites will be in the same field as the field has two central outlets, where runoff volume and water quality is being determined at each outlet. The field will be divided into two distinct management units to provide a control to compare irrigation water management (Conservation Practice Code 449)for soybean. Specifically, the PHAUCET program will be used to determine outlet sizes to equalize pressure and flow volume among furrows while the other half will be used as a control. This will be accomplished by erecting a crop flood-control levee between the two units to hydrologically isolate surface runoff.

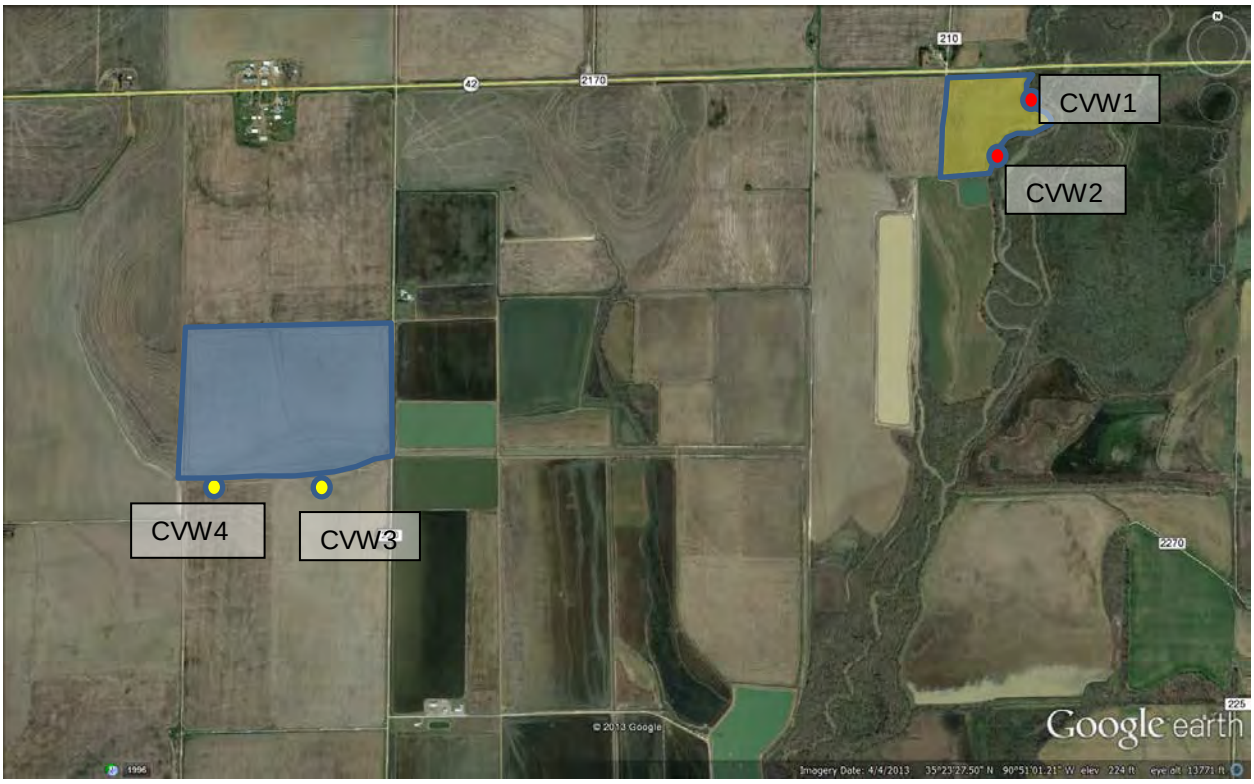

Photo 2. Layout of new monitoring sites CVW3 and CVW4 that will be installed in 2014 on the Mike Wood farm in Cherry Valley, AR relative to the existing sites CVW1 and CVW2.

Photo 3. Close-up on new monitoring sites on the Mike Wood farm. The field currently has two outlets and will be subsequently divided into two distinct management units so that a control and selected irrigation water management practices can be compared for the effect on nutrient and sediment losses in runoff was as well as water use and loss.

Field Description

Field	Field size, acres	Monitoring device
CVW3	58	ISCO 750 Module with area velocity meter inserted into drainage pipe at the edge-of-field.
CVW4	44.5	ISCO 750 Module with area velocity meter inserted into drainage pipe at the edge-of-field.

Soils Description (Photo 4)

Cross County, Arkansas (AR037)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
CrA	Crowley and Hillemann silt loams, 0 to 1 percent slopes	172.0	81.0%
He	Henry silt loam	40.5	19.0%
Totals for Area of Interest		**212.5**	**100.0%**

Photo 4. Soil survey map for the field that will contain CVW3 and CVW4

Existing Crop Production System

Cultural practices in the soybean-rice rotation field that contains monitoring stations, CVW3 and CVW4 are summarized in the following table:

Cultural Practices	Crop	
	Rice (Odd Years)	Soybean (Even Years)
Fertilizer Application Rates	Depending on most current soil test, P fertilizer application rates for rice grown on silt loam soils can range from 0 to 50 lbs/A whereas K fertilizer application rates can range from 0 – 120 lbs/A. N application rates vary by cultivar and ranges from 110 – 180 lbs/A with 2/3 of total applied pre flood and 1/3 third of total applied at mid-season	Depending on most current soil test, P fertilizer application rates for full season soybean grown on silt loam soils can range from 0 to 100 lbs/A whereas K fertilizer application rates can range from 0 – 160 lbs/A. Nitrogen fertilizer is not recommended for soybean
Fertilizer Application Method	Commercial fertilizer containing N-P-K is broadcast on the surface immediately before the rice crop is permanently flooded. At mid-season, the remaining N is broadcast directly into flood using aerial applications	Commercial fertilizer containing P and K is broadcast on the surface at or near planting
Nutrient Management	Because manure is not applied, nutrient applications as commercial fertilizer are guided by soil test recommendations provided by the University of Arkansas' Division of Agriculture.	Because manure is not applied, nutrient applications as commercial fertilizer are guided by soil test recommendations provided by the University of Arkansas' Division of Agriculture.
Tillage / residue Management	Field is lightly disked, roto-tilled and land-plained to prepare seedbed in spring. Tillage is not used for weed control. Rice stubble is rolled in fall to accelerate overwinter decay.	Field is lightly disked, roto-tilled and furrows are erected to prepare seedbed in spring. Tillage is not used for weed control. Soybean residue is left to decay over winter
Irrigation	Once rice emerges, soil levees are erected along the contour in the field to form rice paddys that are flooded through levee gates with irrigation	Soybeans are irrigated using groundwater that is distributed along the top of the fields using polypipe where outlets are punched in the

	water from groundwater or surface water sources. Additional water is added as needed to maintain a permanent flood depth at a minimum of three inches	polypipe to correspond with individual furrows.
Seedbed	Rice is planted using a grain drill	Soybean is planted using a grain drill
Selected Conservation Practice	Conservation tillage is used in the field	The field will be divided in half by erecting a levee down the center of the field that runs parallel with furrows. Runoff from each half will be monitored separately. Irrigation water management (Conservation Practice Code 449) will be utilized on one half, specifically the use of the PHAUCET program to determine outlet sizes to equalize pressure and flow volume among furrows while the other half will be used as a control.

Monitoring System
System Description

Edge-of-field runoff monitoring for sites CVW3 and CVW4 will be in a field that will be divided into two different management units (hydrologically isolated at the surface by flood control crop levee) so that a control and selected irrigation water management practices can be compared side-by-side. Edge-of-field monitoring is comprised of runoff and water flow measured by strategically located drainage pipes at the lower end of each management unit Auto-samplers will be used to collect water samples for analysis of nutrients, and sediments during runoff events produced by precipitation and/or irrigation. Surface runoff water leaving a field will be measured at existing drainage pipes by inserting an area velocity flow meter as part of the ISCO 750 velocity flow module that plugs into the ISCO automated sampler (Photos 6, 7 and 8)


Photo 6. Prototypical monitoring station set up for the new CVW3 and CVW4 stations that will be established on the Mike Wood farm in 2014. The ISCO sampler will be housed in a storage shed attached to a wooden platform (left) and the area velocity flow meter and sampling tube and strainer will be installed into the drainage pipe and secured using a friction-fit scissor ring (left).

Photo 7. ISCO 6712 portable automated water sampler that integrates runoff water quality sampling with a an ISCO 750 flow module that utilizes an area velocity flow meter equipped with sonar to determine both stage height and flow velocity within an open-channel pipe The unit is powered by two 12-volt deep marine batteries in parallel and recharged by a solar panel.

Photo 8. The ISCO 750 area velocity flow module.

Sampling Protocol

Monitoring will take place year round and the goal of the project is to obtain runoff data from every event. Events include rainfall and irrigation induced runoff. A Field Technician will visit the Woods site to collect samples within 24 hours of the rain and runoff stopping. The equipment is set up in a way that runoff samples are collected automatically and can notify the Technician via cell phone technology when samples have been taken. Access to the fields will occur to collect samples and periodically to maintain the sites such as mowing and trimming vegetation around our collection equipment. Anytime a Technician will visit the site, we will do our best to inform the landowner prior to going out to the field.

In the case where irrigation is being applied and sample runoff events are anticipated, the source water will be grab sampled for the constituents below at least once at the beginning of the irrigation season.

All runoff event samples will be analyzed for the following constituents:

- NH4-N (Ammonium only required when animal waste is land applied)
- N02-N + N03-N (Nitrate + Nitrite)
- TKN (Total Kjeldahl Nitrogen)
- Soluble Reactive P (Orthophosphate)
- TP (Total Phosphorus)
- SSC (Suspended Sediment Concentration)

PARTICIPANT REQUIREMENTS

Miscellaneous Requests for Assistance

The only planned assistance from the landowner would be detailed information, twice yearly if possible on land management, tillage, timing of field operations, nutrient management, planting dates, etc.

Reporting Requirements

Monitoring data provided to NRCS contains Personally Identifiable Information (PII). At a minimum, these data must be transmitted in a zipped and password protected format.

FARMER INVOLVEMENT

Implications of effects of conservation strategies employed on each farm will be evaluated and discussed by the producer, participating scientists, and natural resource managers as appropriate. A final evaluation of water quality changes or improvements at each site may be conducted at the end of the five to seven year evaluation period and at the time of the farm's graduation out of the program.

System Installation

The Monitoring Conservation Activity Installation Report (Appendix B) will be submitted. An approved Water Quality Monitoring Plan and a QAPP must be submitted and approved as a part of the installation. The historic operations form (Appendix F) should be submitted with the installation report. NRCS must complete a quality assurance check of existing practice management (Appendix F) known as the Annual Field Check form. These forms, along with digital photos[1] of the installation, serve as the documentation for the system installation.

Semi-Annual Data Submittal

For each water quality station, rainfall and flow data will accompany electronic (.pdf) copies of the laboratory analysis for each event. Weekly or bi-weekly checklists and/or a log book should provide information about the performance of the monitoring system, specifically noting any malfunctions, gaps in data collection, or conditions that might be useful in interpreting the results of collected data. The operations form (Appendix F) should be completed for the reporting period. An Excel spreadsheet (Appendix A) containing all water quality data for all the events of the reporting period will be submitted. All information in this paragraph is required as the documentation for a semi-annual data submittal.

Annual Submittal

The annual submittal includes all requirements of a semi-annual data submittal for the second half of the monitoring year. In addition, this report will summarize the findings for the year and will include a status review with the participant. The data should be summarized in such a way that it is meaningful to the participant. NRCS must complete a quality assurance check of existing practice management (Appendix F) known as the Annual Field Check form. All information in this paragraph is required as the documentation for an annual submittal. The report should include:

1. Summary data –Tabular (Peak and Total Discharge, Precipitation or Irrigation and Load)
2. Graphs – Discharge (cfs), Runoff (inches) and Load (lbs/acre)
3. Interpretation of graphical data

[1] Maximum allowable photo resolution is 1.9 megapixels (1600X1200). All photographs must be date stamped.

4. Discuss comparison of control and treatment sites
5. Explain Results
    a. Event mean concentration (EMC) vs. discharge
    b. Unexpected events (data outliers)
6. Explain the difference between nutrient inputs and nutrient loads leaving the field (lb/acre)
    a. Physical effects
    b. Biological effects
    c. Economic effects
    d. Potential operational adjustments to reduce off-site loss (must state whether adjustment is allowable at the specific sites being monitored in the document and discuss at meeting)

7. Potential data collection issues
    a. Issues to be resolved
    b. Issues to improve data collection or cooperation in getting quality data

8. Issues associated with data loss or inability to collect data for a time period (due diligence)

Comprehensive Report

A comprehensive report with an executive summary is required at the end of the monitoring period. This report will include a summary of all annual report contents for the period of analysis. Any correlation of in-stream, outlet of the HUC 12 (if these exist) and edge-of-field monitoring should be mentioned. The report should discuss the effectiveness of the practice(s) and any determined statistical significance of the collected data. The report should have a comparison of treated and control sites using graphs and tables to assist in showing load effects relative to discharge and precipitation or irrigation applied. All information in this paragraph is required.

The report should include:

1. Summary data –Tabular (Peak and Total Discharge, Precipitation or Irrigation and Load)
2. Graphs – Discharge (cfs), Runoff (inches) and Load (lbs/acre)
3. Interpretation of graphical data
4. Discuss comparison of control and treatment sites
5. Active in-stream monitoring within HUC-12 or smaller watershed where edge-of-field monitoring occurred.

a. Station location
b. Time frame of secondary data
c. Graphics and text explaining any statistical correlation between practice and in-stream data on activity constituents.

6. Practice(s) effectiveness evaluation
    a. Statistical analysis used (describe any data transformations)
    b. Results of analysis
        i. Event mean concentration (EMC) vs. discharge
        ii. Unexpected events (data outliers)
7. Explain the difference over the monitoring period between control and treatment for nutrient inputs versus nutrient loads (lb/acre) and sediment yields (tons/acre) leaving the field. The report should make a connection between off-site nutrient and sediment loss and the following:
    a. Physical effects
    b. Biological effects
    c. Economic effects
    d. Potential operational adjustments to reduce off-site loss (must state whether adjustment is allowable at the specific sites being monitored in the document and discuss at meeting)
8. Implications of Statistical Analysis
    a. Was practice(s) effective?
    b. If not, what is the reasoning?
    c. Any suggested changes to improve practice effectiveness on similar sites to those monitored.

MONITORING TIMELINE

Due Date	Tract	Field	Station ID	Activity
4/1/2014				Monitoring equipment installed
1/15/2014				Prepare annual report
1/31/2014				Meet with participant to discuss 2013 data
7/15/2014				Prepare annual semiannual report
7/31/2014				Meet with participant to discuss data
1/15/2014				Prepare annual report for participant
1/31/2015				Meet with participant to discuss 2014 data
7/15/2015				Prepare annual semiannual report
7/31/2015				Meet with participant to discuss data
1/15/2016				Prepare annual report for participant
1/31/2016				Meet with participant to discuss 2015 data
7/15/2016				Prepare annual semiannual report
7/31/2016				Meet with participant to discuss data
1/15/2017				Prepare annual report for participant
1/31/2017				Meet with participant to discuss 2013 data
7/15/2017				Prepare final report
7/31/2017				Meet with participant to discuss final report

APPENDIX D

NRCS QUALITY ASSURANCE PROJECT PLAN

Edge-of-field Monitoring of Effects of Implementing Conservation Practices on Nutrient and Sediment Runoff in L'Anguille River Watershed Coalition MRBI project

Prepared for:

Mike Wood,

Prepared by:

Mike Daniels
University of Arkansas
Division of Agriculture
Cooperative Extension Service
Little Rock, AR 72204

February 17, 2014

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Quality Assurance Project Plan (QAPP)

This document provides an outline and description of minimum information required in each section for the QAPP when a project does not use EPA funds. When a project uses EPA funds, an EPA QAPP will be required. The participant will be responsible for the content in the QAPP and approval by EPA.

SECTION 1.0: PROJECT OVERVIEW AND OBJECTIVES

This project will be performed on private land controlled by Mike Wood in the L'Anguille River Watershed Coalition project under the Mississippi River Basin Healthy Watershed Initiative. Edge-of-field monitoring will occur at two locations on one field as two central outlets exist on the Woods Farm, Cherry Valley, Cross County. The monitored field will be under soybean and rice rotation. The monitoring will assess the impact of irrigation water management (Conservation Practice Code 449) on nutrient and sediment loss in runoff. Crop yields will also be obtained from the participant to determine the crop production benefits of these conservation measures. Finally, irrigation water inputs will be measured using a turbine type irrigation flow meter to determine water use.

Overall, we will determine the cost-effectiveness of qualified conservation practices on at reducing nutrient and sediment runoff in L"Aguille River Watersehed Coalition focus watershed.

SECTION 2.0: PROJECT ORGANIZATION AND MANAGEMENT

2.1 Project Contacts

Table 2.2. Project Roles & Responsibilities

Individual(s)	Responsible for:	Authorized to:
Mike Daniels, Professor, Phone: (501) 671-2281 Cell: (501) 944-0995 Email: mdaniels@uaex.edu	• Program implementation • Data interpretation • Report compilation	• Manage project • Action
Cory Hallmark, Discovery Farm Technician, Phone: (501) 671-2230	• Data collection • Sample collection • Spreadsheet preparation	• Manage sites • Collect samples • Identify and correct field issues
Tarra Simmons, Program Technician Phone: (479) 575-3623 Email: tarra@uark.edu	• Sample preparation for analysis • Sample analysis • Compilation of results	• Conduct sample analysis • Report any errors or issues in the laboratory

SECTION 3.0: MONITORING APPROACH

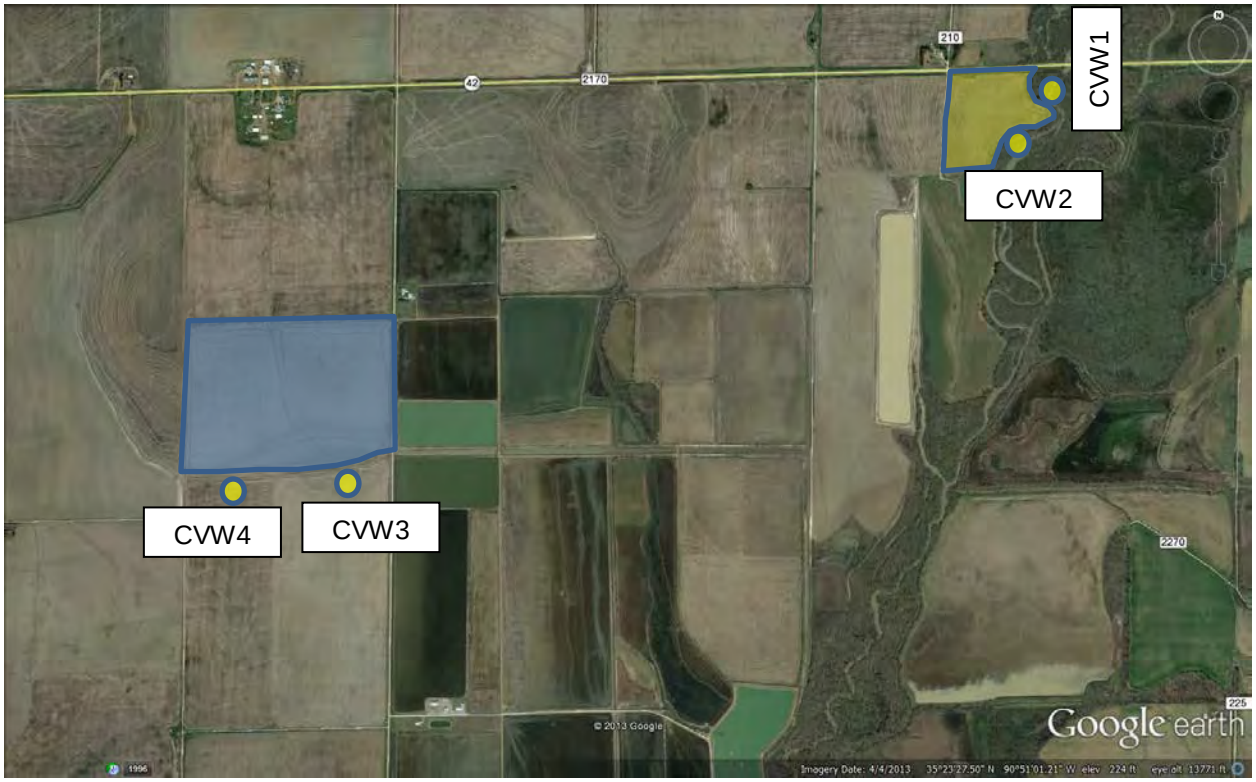
1. *Monitoring design*

Monitoring at each site will be comprised of runoff and water flow measured by strategically located open-channel drainage pipes. Auto-samplers will be used to collect water samples for analysis of nutrients, and sediments during flow – runoff events. At each field site, surface runoff water leaving a field will be measured at existing drainage pipes already in place as part of the field management and drainage operation. These pipes accumulate runoff water leaving a field to one point allowing continous measurement of flow volumes and rates by automatic stage height and transducer equipment.

Baseline monitoring will not be utilized since the irrigation water management treatment will be compared to a control.

Location

2.



Woods farm location

Location of monitoring Stations on Woods field.

3. *Monitoring duration and frequency*

All runoff events induced by either rainfall or irrigation on any given field will be monitored and runoff samples and flow collected. Flows will not be monitored and samples not collected during freezing conditions due to the potential very expensive damage that can be caused if transducers or water in samplers freezes. The periodicity of sample and data collection is dependent of local weather conditions and then number and extent of monitored events cannot be estimated from year to year. However, irrigation-induced runoff is easier to predict and will be dependent of when crops need irrigating.

4. *Major agricultural pollutant of concern of the HUC12*

The pollutant of concern in this HUC12 is the nutrients nitrogen and phosphorus and suspended sediment.

5. ***Irrigation source water quality***

Irrigation source water quality will be determined by taking a sample of irrigation water used for each irrigation event. The irrigation water sample will be treated the same as runoff water and the same analytes will be determined.

6. ***Constituents to be monitored***

All runoff event samples will be analyzed for the following constituents:

- NH4-N (Ammonium only required when animal waste is land applied)
- N02-N + N03-N (Nitrate + Nitrite)
- TKN (Total Kjeldahl Nitrogen)
- Soluble Reactive P (Orthophosphate)
- TP (Total Phosphorus)
- SSC (Suspended Sediment Concentration)

7. ***Practice(s) being monitored***

Practices monitored include;

Conservation Crop Rotation CPS 328

Irrigation management CPS 449

All these practices are designed to prevent, control, or trap nutrients and sediments, which have been identified as pollutants of concern in this watershed.

8. Estimated potential adoption and application of the monitored practices is about 1,000 acres.

SECTION 4.0: SAMPLE PROCEDURES

Water quality sampling station at the Woods farm.

Sampling equipment at each monitored site. ISCO 6712 auto samplers will be used at all sites coupled with an ISCO submersible pressure transducer.

1.

2. Sample collection: Water

At each field outlet site, an automatic water sampler (ISCO 6712 Full Size Portable Sampler) is installed to collect runoff samples at predetermined intervals during a discharge event (see Photos 4, 5, and 6). Runoff from the field is measured by an ISCO 720 submerged probe pressure transducer in conjunction with a box weir integrated into the crop flood control levee Sensor located in the culvert draining each field. A water sample is collected on a unit flow basis, such that a composite flow-weighted sample for the whole discharge event is obtained. This sample is collected from the auto-sampler within 24 hours of collection for determination of N, P, and sediment concentration, as described below.

For row crop situations where irrigation is utilized, irrigation inflow will be measured with in-pipe flow meters to determine application rates and cumulative irrigation volume.

A weather station that is linked to the ISCO sampler data logger will be located at the site to determine rainfall amounts at 5 to 15 minute intervals. All samplers and flow meters have been calibrated to factory specification, given the dimensions of the pipe they are located in. Any unexpected response in the sampler, flow meter or weather station will be immediately noted and corrected.

Automated water samplers will be programmed to deliver a composite water sample into a clean, acid washed polyethylene bottle. Water samples will then be placed in clean, acid washed polyethylene bottles with caps and labeled with site number, date, time and collector's name and transferred as quickly as possible to the certified laboratory. Samples for dissolved P, nitrate-N and ammonium-N will be filtered through a 0.45 μm membrane into a sterile glass vile and stored at 4 ^{o}C in the dark along with unfiltered samples, within 24 hours of collection. Dissolved P, nitrate-N, and ammonium-N will be determined colorimetrically by standard US EPA methods. Total N and P will be determined by the same colorimetric methods after Kjeldahl digestion of an unfiltered water sample. Particulate P is calculated as the difference between total and total dissolved P. The suspended sediment concentration of collected runoff water samples is determined gravimetrically as the difference in weights between oven-dried (105 ^{o}C) unfiltered and filtered samples.

3. Sample collection: Soil

Soil samples will be collected at a depth of 6" each spring. A sub-sample will be taken for analysis. Samples can be held indefinitely once thoroughly mixed and air-dried. The samples will be delivered to the University of Arkansas Soil Testing Laboratory where they will be analyzed. Analysis will include Mehlich-3 soil test P.

Parameter	Container	Volume	Preservative
Mehlich-3 soil test P	Paper box (new)	1 Pint	Air dry within 2 days and store at room temperature

4. Sample processing

All samples must be labeled at the time of collection. The label must contain at a minimum the following items: the location; the date taken; and the type of sample.

Field notes must contain at a minimum the same information as the sample tag and any field measurements and other information necessary to reconstruct the sample collection process. All entries should be signed and all pertinent field notes should be transferred to laboratory files.

The sample collector is responsible for the care and custody of the samples until they are transferred to the laboratory. The sample collector must provide the proper storage conditions and insure the delivery of the samples within the permitted holding times. The samples must be in his physical possession or in his view or stored in a controlled place at all times.

5. Laboratory custody

All samples received in the laboratory will be recorded in a laboratory logbook with the sample description, date and time of collection, name of person collecting sample, the date and time received and the person receiving the sample.

The Program Technician will receive the samples and is responsible for labeling the samples with the proper laboratory identification number and distributing the samples to the laboratory personnel, or storing samples under the appropriate conditions. In the event of the Program Technician's absence, the PI, Mike Daniels via Andrew Sharpley will designate a substitute.

The laboratory personnel are responsible for the care and custody of a sample once it is assigned to them.

Once sample analysis is completed, the unused portion of the sample, with identifying labels and any other documentation must be returned to the Program Technician for disposition. Samples should never be destroyed without and order from the PI, Mike Daniels. All sample records will be retained as part of the laboratory's permanent record.

SECTION 5.0: TESTING AND MEASUREMENT PROTOCOLS

Variable: Total Phosphorus
Medium: acid digests of water and litter
Units: mg/L (for water), mg/kg (for litter)
Practical Quantation Limit: 0.02 mg/L
Test Method: Persulfate Digestions and ascorbic acid method for analysis, EPA 4500 P and EPA 365.2

Variable: Dissolved reactive (Ortho) Phosphorus
Medium: water and water extracts of litter
Units: mg/L (for water), mg/kg (for litter)
Practical Quantation Limit: 0.005 mg/L
Test Method: Ascorbic acid method for analysis, EPA 365.2
Variable: Total Nitrogen

Medium: acid digests of water and litter
Units: mg/L (for water), mg/kg (for litter)
Practical Quantation Limit: 0.1 mg/L
Test Method: Persulfate Digestions and alkaline phenol and hypochlorite colorimetric method for ammonia, EPA 4500 and EPA 350.1

Variable: Nitrate Nitrogen
Medium: water
Units: mg/L
Practical Quantation Limit: 0.1 mg/L
Test Method: Brucine sulfate method for colorimetric analysis, EPA 352.1

Variable: Ammonium Nitrogen
Medium: water
Units: mg/L
Practical Quantation Limit:
Test Method: Semi-automated alkaline phenol and hypochlorite colorimetric method for ammonia, EPA 350.1

Variable: Total solids
Medium: water
Units: g/L
Practical Quantation Limit: 0.01 g/L
Test Method: Gravimetric analysis, EPA 160.4

SECTION 6.0: QUALITY ASSURANCE / QUALITY CONTROL (QA/QC)

1. Quality control requirements

The quality of data from the laboratories will be assured by a system of internal checks. These include equipment checks, reagent checks, and laboratory performance checks. The results of these checks will be recorded to verify the operation of the quality control system and to monitor any changes that occur.

2. Control limits for QC checks

Samples will be re-run if the average duplicate recovery is not between 95 and 105% or the average recovery is not between 90 and 110%.

3. Laboratory Performance Checks

All chemical analyses will be checked for precision by the analysis of duplicate laboratory samples. The frequency of duplicate analysis will be approximately one in ten samples. At least one duplicate analysis must be done each day a parameter is run. The results of the analyses must be recorded and filed with the Program Technician.

All chemical analyses possible will be checked for accuracy by the analyses of spiked samples. The frequency of spiked sample analyses will be approximately one in 20 samples. These spiked samples will be prepared by the addition of a known amount of the substance to an aliquot of the duplicate sample. The results must be recorded on the spike sample sheet and control charts and filed with the Program Technician.

Check samples from an outside source will be analyzed biannually. Either samples from EPA or commercially prepared samples will be used. The analyst should perform the analysis without knowing the expected value.

In the event that problems are discovered with a specific laboratory analysis, the Program Technician will contact Mike Daniels and discuss the problem. Appropriate action will be taken to solve the problem. These problems and corrective actions taken will then be reported to the NRCS QA Officer.

4. Instrument equipment testing, inspection, and maintenance requirements

A notebook will be kept on each piece of equipment in the laboratory, which includes information on maintenance. All equipment testing, inspection and maintenance follows the guidelines detailed in the Standard Operating Procedures of the laboratory.

Analytical balance

All analytical balances must be cleaned weekly and immediately after any chemical spills.

The balance table must be kept neat and cleaned after any spills.

All analytical balances must be cleaned and checked annually or whenever a problem is found.

Inductively coupled plasma emission spectrophotometer

The preventative maintenance schedule is followed as recommended by the manufacturer. The following spare materials should be maintained in hand; (1) glass fiber optics and (2) an additional torch.

Technicon AutoAnalyzer II

Double-distilled water should be pumped thoroughly through the tubing at the end of a run. Pump tubing should be replaced immediately upon sign of wear. All colorimeters should be turned off, and the pump platen removed at the end of a run. The pump should be oiled with light weight oil as needed.

5. Instrument Calibration and Frequency

All instruments and equipment will be calibrated according to the manufacturer's recommended procedures and the guidelines in the Handbook for Analytical Quality Control in Water and Wastewater Laboratories, EPA-600/4-79-019. In addition, the following specific procedures will be followed.

The Inductively Coupled Argon Plasma Emission spectrophotometer must be calibrated initially with a minimum of two standards, a blank and a mixed standard of analytes. Linearity above the

high standard should be checked by analyzing known standards. Check standards should be run approximately every 10 samples, and should fall within 10% of expected values. If not, stop sample analysis, correct any problems, and recalibrate. Samples run just prior aid termination of analysis should be reanalyzed.

6. Validation and Verification Methods

The precision, accuracy and completeness of laboratory data will be inspected immediately after the analyses are performed. Data from duplicate and spiked samples will be recorded and plotted on quality control charts to assure that the results are within the acceptance limits.

The precision, accuracy and completeness charts are designed to hold approximately one month's data. New charts will be started each month. Records and charts will be reviewed by the PI, Mike Daniels.

The laboratory control checks will consist of laboratory duplicates to contain 10% of total samples on each run. These checks will monitor the levels of precision and accuracy of the collection and analytical processes. Duplicates will fall within 10% of the expected values to be considered valid. In addition, after every 30 samples, a laboratory standard and an EPA certified standard will be run to check accuracy. These standards must also fall within 10% of expected values.

These values will be calculated at the end of each daily run. In the event that the QA does not meet these requirements, then the data will not be used.

SECTION 7.0: DATA HANDLING PROCEDURES

Subsection 7.1: Methods for Data Acquisition and Storage

Monitoring data provided to NRCS contains Personally Identifiable Information (PII). At a minimum, this data must be transmitted in a zipped and password protected format.

Data will down loaded from the data logger on the ISCO samplers to a laptop by the Field or Program Technician at routine intervals to ensure no flow and rainfall data is lost. All of the field data is transferred to the bench sheets where analytical data is recorded.

Precision and accuracy of data checked and results are recorded on quality assurance charts. Data is reviewed for completeness and arithmetical errors and prepared for data processing. Data is entered into a computer file. A printout of entered data is obtained and manually checked against laboratory forms and the data will be scanned for out-of-range values.

Data will be stored as an Excel file on a desktop in the laboratory and on a backup external drive. Hard copies of laboratory data report will also be kept on file. Field log books will be kept in the laboratory. Information on land management and cultural practices provided by the landowner will be entered into an Excel spreadsheet and kept on the laboratory computer.

Subsection 7.2: Methods of Analyses

The precision and accuracy of a test method will be determined by analyzing samples to which known quantities of standard substances have been added. The procedures used will follow those described in APHA Standard Methods of Examination of Water and Waste Waters, Edition 18, Section 1020B. The average spike recovery for a given day must fall within 95% - 105% recovery to be considered acceptable. Least significant differences (LSD) after NOVA will be used as a statistical consideration for assessment of nutrient and metals reductions since LSD after NOVA has indicated that a significant difference at the 0.05 levels exists. Control charts will be continuously maintained for each test method and updated quarterly.

Completeness will be determined as the ratio between the number of samples received vs. the number satisfactorily completed. This ratio will be expressed as a proportion or percent. Completeness for laboratory standards will be expressed as a proportion or percent of standards, spikes and duplicates which fall within the criteria established for precision and accuracy (see above section). The completeness goal is at least 90%.

Completeness charts will be continuously maintained for sample sets as part of the chain-of-custody information. If completeness requirements are not met for any parameters then the samples will be rerun or the simulations will be repeated as deemed necessary.

Subsection 7.3: Data Analysis

Flow data for each runoff event will be downloaded from the ISCO sampler to a field laptop computer. Peak and total flows for each event will be determined. A single water sample for each runoff is collected by the ISCO sampler. ISCO samplers are programmed to collect a 250 mL sample every 1000 gallons of water passing through the monitored culvert. This sampling protocol will give one sample per event and will provide a flow-weighted value.

Flow-weighted nutrient and sediment concentrations for each runoff event will be multiplied by total flow for that event to calculated event nutrient and sediment discharge. Data for nutrient and sediment fate and transport form each field will be reported as flow-weighted concentration and load or loss per unit field area.

Due to the unique soil, hydrologic, and flow properties of the monitored fields, each site will be considered a treatment and not paired replicates. Flow-weighted concentrations and loads for each event during a calendar year among treatment sites will be compared by analysis of variance.

SECTION 8.0: ASSESSMENT AND OVERSIGHT

Visual inspection of field monitoring sites will be made at the time of sample collection. Any debris that may be influencing flow readings will be removed. Periodic site maintenance visits will ensure a timely correction of any site disturbance that could potentially influence flow estimation.

If a particularly large rainfall / storm is predicted the sample interval can be increased to collect a sample when a larger volume of water has passed though the monitoring site. For instance, the 1000 gallon sampling volume can be increased to 2000 or 3000 gallons depending on weather predictions and field experience. In this way we will better ensure the likelihood of the sampler capacity not exceeding the flow event.

An internal annual review of the monitoring process will be conducted. A checklist or series of questions will be developed to determine if the methods outlined in the QAPP are being followed for each storm and if not, why and what actions were taken to resolve any issues.

Sampling protocols are such that it is not expected that the 48 hour sampling holding times will be exceeded for dissolved P measurement. In the cases where these times are exceeded, the sample log will be noted but chemical analysis will proceed as normal.